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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : G07C 5/08 — A1

(11) International Publication Number: WO 90/09645

(43) International Publication Date: 23 August 1990 (23.08.90)

(21) International Application Number: PCT/GB90/00221

(22) International Filing Date: 12 February 1990 (12.02.90)

(30) Priority data:
8903123.1 11 February 1989 (11.02.89) GB

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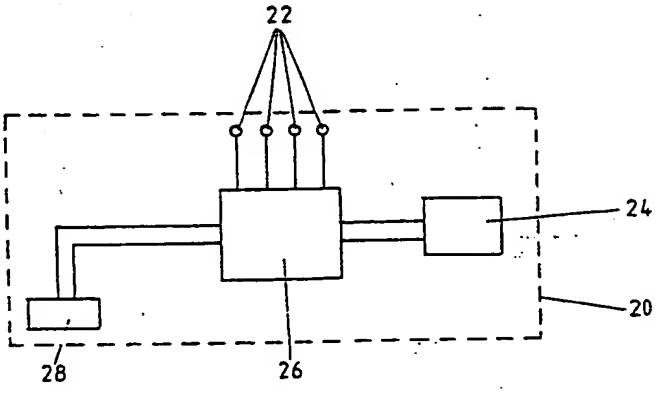
(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FI, FR (European patent), GB, GB (European patent), HU, IT (European patent), LU (European patent), NL (European patent), NO, RO, SE (European patent), SU.

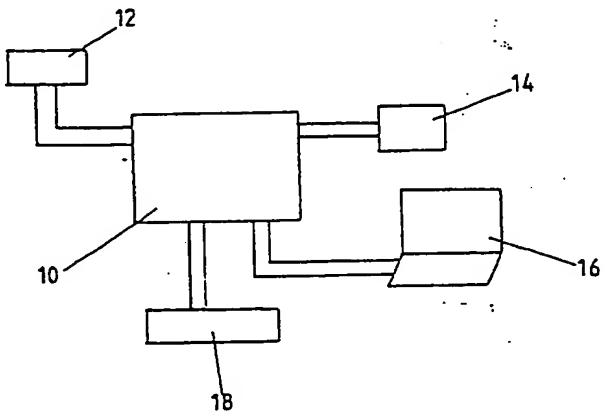
Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: VEHICLE MONITORING SYSTEM

(57) Abstract

A vehicle monitoring system comprises a unit (20) fitted on board a vehicle to monitor and record vehicle operating parameters, and a data processor unit (10) located at a base station to analyse data recorded by the on-board unit. A radio transmission system (28, 12) communicates the recorded data from the on-board unit to the base station data processor whilst the vehicle is on the road remote from the base station. The base station data processor is able to analyse the recorded data for preventive maintenance prurposes.





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Vehicle Monitoring System

This invention relates to a system for monitoring and recording operating parameters of a vehicle.

Systems are known for acquiring and recording data in respect of the operating parameters of a vehicle and enabling this data to be analysed at a central or base station. In US patent 4 188 618, data in respect of e.g. vehicle speed, trip distance, engine r.p.m. and fuel consumption is recorded in a data memory on-board the vehicle. When the vehicle reaches a base station, this data is transferred into a central computer of the base station, either by a direct cable connection which is made between the on-board system and a terminal of the central computer, or by a short-range radio transmission which is triggered by a proximity detector when the vehicle arrives. In the system disclosed in South African patent 8 401 416, data in respect of vehicle operating parameters is recorded in an on-board solid state acquisition unit, which can be removed when the vehicle reaches a base station and connected into a central computer for analysis of the data. However, it will be appreciated that in these known systems, the vehicle operating data can only be acquired by the base station once the vehicle arrives at that station. Further, whilst the on-board system of South African patent 8 401 416 can determine and notify the driver if a sensed parameter e.g. engine oil pressure departs from a safe limit, in effect this is only an emergency indication that a fault has already developed and a safe limit has been passed, and provides little advance notice that a fault is starting to develop.

In accordance with this invention, there is provided a vehicle monitoring system comprising a unit fitted on board the vehicle which monitors and records

vehicle operating parameters, a data processor unit located at a base station for analysing the data recorded by the on-board unit, and a radio transmission system for communicating the recorded data from the on-board unit to the base station data processor whilst the vehicle is on the road remote from the base station.

Thus the acquired data can be communicated from the vehicle to the base station at any desired time. The data transmission may occur automatically at fixed intervals, or when demanded by the base station processor: for the latter purpose the base station may poll different vehicles in turn over the radio transmission system to cause the data recorded on each vehicle to be transmitted back to the base station processor. The recorded data may be transmitted from the vehicle to the base station at least one a week and typically once or twice a day.

The data which is recorded on the vehicle preferably includes road speed, engine speed (r.p.m.), distance travelled, fuel consumption, cylinder head temperature, exhaust gas temperature, engine and transmission oil pressures, and water temperature: all of this data is recorded in real time.

The base station processor is able to analyse such data for the purpose of managing a fleet of vehicles. Further, certain data (vehicle speeds, distances travelled, engine r.p.m.) can be processed to determine a proficiency rating for the driver, which can be useful particularly when training the driver. For example, the exhaust gas temperature should remain substantially constant if the driver is driving correctly (e.g. keeping the vehicle in correct gear under different conditions), and so it is useful if the base station processor analyses variations in the exhaust gas temperature.

Further however, the base station processor preferably analyses the data from each vehicle to derive

vehicle diagnostic or preventative maintenance reports. For example, the base station processor can determine if any recorded parameter departs from a predetermined value for greater than a predetermined time period (e.g. if the cylinder head exceeds a predetermined temperature, or if the oil or water pressures fall below a predetermined level). In this manner, the base station processor can provide a report giving an early warning that the vehicle is developing a fault and should be brought in for maintenance before long. For a similar purpose, the processor may analyse the pressure and temperature variations to determine any trends which may indicate that the vehicle is developing a fault.

An embodiment of this invention will now be described by way of example only and with reference to the accompanying drawing, the single figure of which is a schematic block diagram of a vehicle monitoring system in accordance with the invention.

Referring to the drawing, there is shown a vehicle monitoring system comprising a data processor unit 10 located at a fixed base station and including a radio transmitter/receiver 12, data store 14, keyboard and display unit 16 and a printer 18. The system further includes a data acquisition unit 20 which is fitted on-board a vehicle and includes sensors 22 which monitor the various vehicle parameters in real time, a solid state data store 24, a central processing unit 26 and a radio transmitter/receiver 28. In practice the overall system will comprise a plurality of data acquisition units on-board respective vehicles in the fleet.

In operation, the sensors 22 on each vehicle continuously monitor the sensed parameters and a record is made in real time in the data store 24 under control of the central processing unit 26. The sensed and recorded data includes road speed, engine speed (r.p.m.), distance

travelled, fuel consumption, cylinder head temperature, exhaust gas temperature, engine and transmission oil pressures, and water temperature.

The recorded data is transmitted by radio to the base station as desired. For example, the data may be transmitted automatically from each vehicle at regular intervals of time. Alternatively, the data may be transmitted when "called" by the base station; preferably the vehicles are polled in turn either on demand or at regular intervals. The data can be transmitted by radio to the base station whilst the vehicle is on the road and therefore remote from the base station.

The base station processor analyses the received data for each vehicle, firstly for fleet management purposes and secondly for preventative maintenance purposes. As described above, the data can also be processed to determine a proficiency rating for the driver. Reports which are determined by the processor are displayed on the display unit 16 and/or printed out by the printer 18.

For the preventative maintenance function, the processor 10 analyses the data for each vehicle and determines and reports any variations or abnormalities or trends which indicate that the vehicle may be developing a fault. For example, the pressure and temperature variations are analysed for any particular trends; also various parameters are monitored to determine if they depart from a predetermined value for greater than a predetermined time period (e.g. if the cylinder head temperature exceeds a given value for an excessive time, or if the oil pressure falls below a given level for an excessive time). Any report provided by the processor may indicate the suspected fault and require the vehicle to be brought in for attention ahead of its scheduled service. If any report indicates an unsafe operating condition, this

may be communicated directly to the driver over the radio transmission link.

It will be appreciated that the system which has been described enables the data recorded on each vehicle to be made available promptly and analysed at the base station whilst the vehicle continues working without the need for the vehicle to call in at the base station or at any outlying stations or depots. Further, the data can be analysed to provide early warnings that the vehicle is developing a fault, so that preventative maintenance can be practised.

Further however and in accordance with a development of the system, a facility for automatic recalibration in respect of road speed may be provided. Thus, two radio beacons can be set up at a predetermined distance apart on selected roadways, directing their beams across the road. When a vehicle which has a system in accordance with the invention passes along such a roadway, it responds when traversing the radio beam of the first beacon to count the pulses from the road speed detector until the vehicle traverses the radio beam of the second beacon. From a knowledge of the distance between the two radio beacons, the speed of the vehicle is determined automatically and the system is recalibrated with respect to the pulses delivered from the road speed detector. With recalibration variations in the diameter of the roadwheel can be prevented from affecting the measured roadspeed.

CLAIMS

1) A vehicle monitoring system comprising a unit for fitting on board a vehicle to monitor and record vehicle operating parameters, a data processor unit for location at a base station to analyse data recorded by the on-board unit, and a radio transmission system for communicating the recorded data from the on-board unit to the base station data processor whilst the vehicle is on the road remote from the base station.

2) A vehicle monitoring system as claimed in claim 1, in which the radio transmission system is arranged to communicate the recorded data from the on-board unit to the base station data processor at fixed intervals of time.

3) A vehicle monitoring system as claimed in claim 1, comprising a plurality of said on-board units for fitting to respective vehicles, and the radio transmission system is arranged for the base station to poll the different vehicles in turn to cause the respective vehicles to transmit their recorded data to the base station.

4) A vehicle monitoring system as claimed in any preceding claim, in which the data which the or each on-board unit is arranged to monitor and record comprises at least one of road speed, distance travelled, fuel consumption, cylinder head temperature, exhaust gas temperature, engine oil pressure, transmission oil pressure, and water temperature.

5) A vehicle monitoring system as claimed in claim 4, in which the base station processor is arranged to analyse the data which it receives for the purpose of

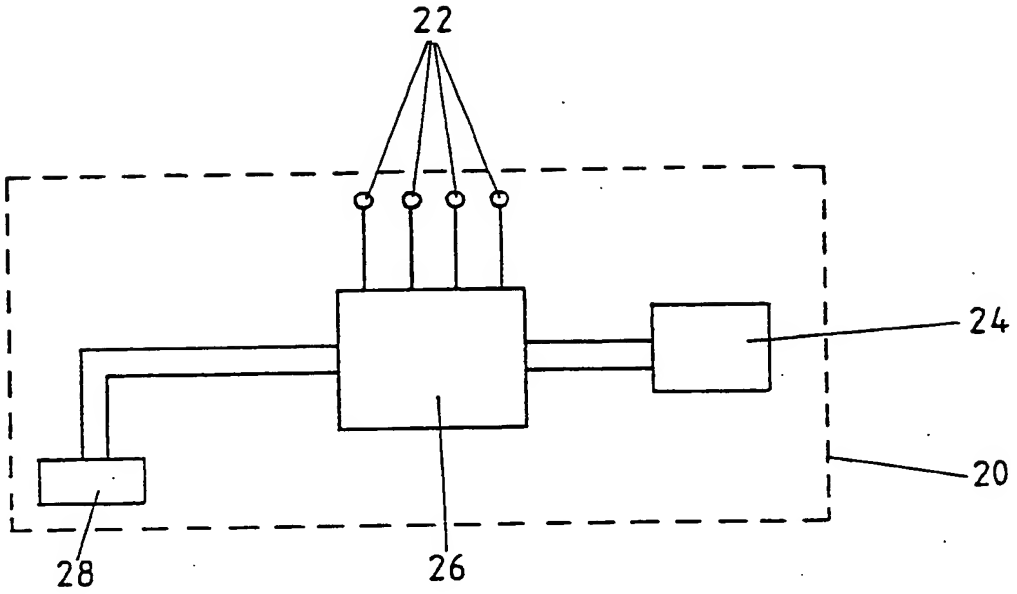
managing a fleet of vehicles.

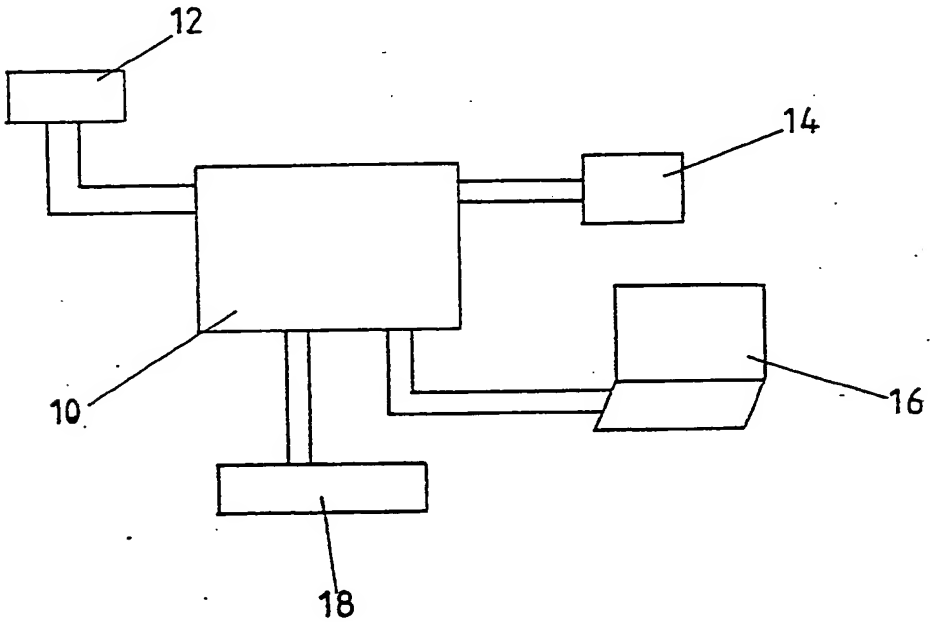
6) A vehicle monitoring system as claimed in claim 4 or 5, in which the base station processor is arranged to analyse the data which it receives for the purpose of preventative maintenance.

7) A vehicle monitoring system as claimed in claim 6, in which the base station processor monitors at least one vehicle parameter to determine if it departs from a predetermined value for greater than a predetermined time period.

8) A vehicle monitoring system as claimed in claim 6, in which the base station processor monitors at least one vehicle parameter to determine any long-term change in that parameter indicative of the vehicle developing a fault.

9) A vehicle monitoring system as claimed in any one of claims 4 to 8, in which the base station processor monitors at least one vehicle parameter to determine a proficiency rating for the vehicle driver.





INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 90/00221

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 G07C5/08

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	G07C ; G08G

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category[10]	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	EP,A,0292811 (MOTOROLA) 30 November 1988 see column 3, line 23 - column 6, line 42; claims 1-10; figures	1, 3
Y		5-9

X	WESCON TECHNICAL PAPERS. vol. 20, no. 20, 1976, NORTH HOLLYWOOD US pages 1 - 10; BRAVMAN e.a.: "Automatic vehicle monitoring" see page 1, column 1, line 39 - page 1, column 2, line 17 see page 4, column 1, lines 8 - 17; figures	1-3

X	FR,A,2438877 (BARANOFF) 09 May 1980 see page 1, line 4 - page 3, line 20; figures	1, 2
A		4

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
31 MAY 1990	21. 06. 90
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	MEYL D.

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
X	EP,A,0032607 (BAUMANN) 29 July 1981 see page 3, lines 13 - 27 see page 10, line 1 - page 11, line 10; figure 1	1, 3
Y		5
A		2, 4, 6-9
X	US,A,4188618 (WEISBART) 12 February 1980 see column 3, line 28 - column 4, line 53 see column 6, lines 4 - 55; figures	1
Y	(cited in the application)	4, 9
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A		4-6, 9
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Y	PATENT ABSTRACTS OF JAPAN vol. 12, no. 182 (M-702)(3029) 27 May 1988, & JP-A-62 291435 (NISSAN MOTOR) 18 December 1987, see the whole document	4
Y	GB,A,2127554 (PORSCHE) 11 April 1984 see page 1, line 16 - page 2, line 8; claims 1-15; figures	6-8
A		4

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. GB 9000221

SA 34346

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 01/06/90
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